ANNUAL REPORT

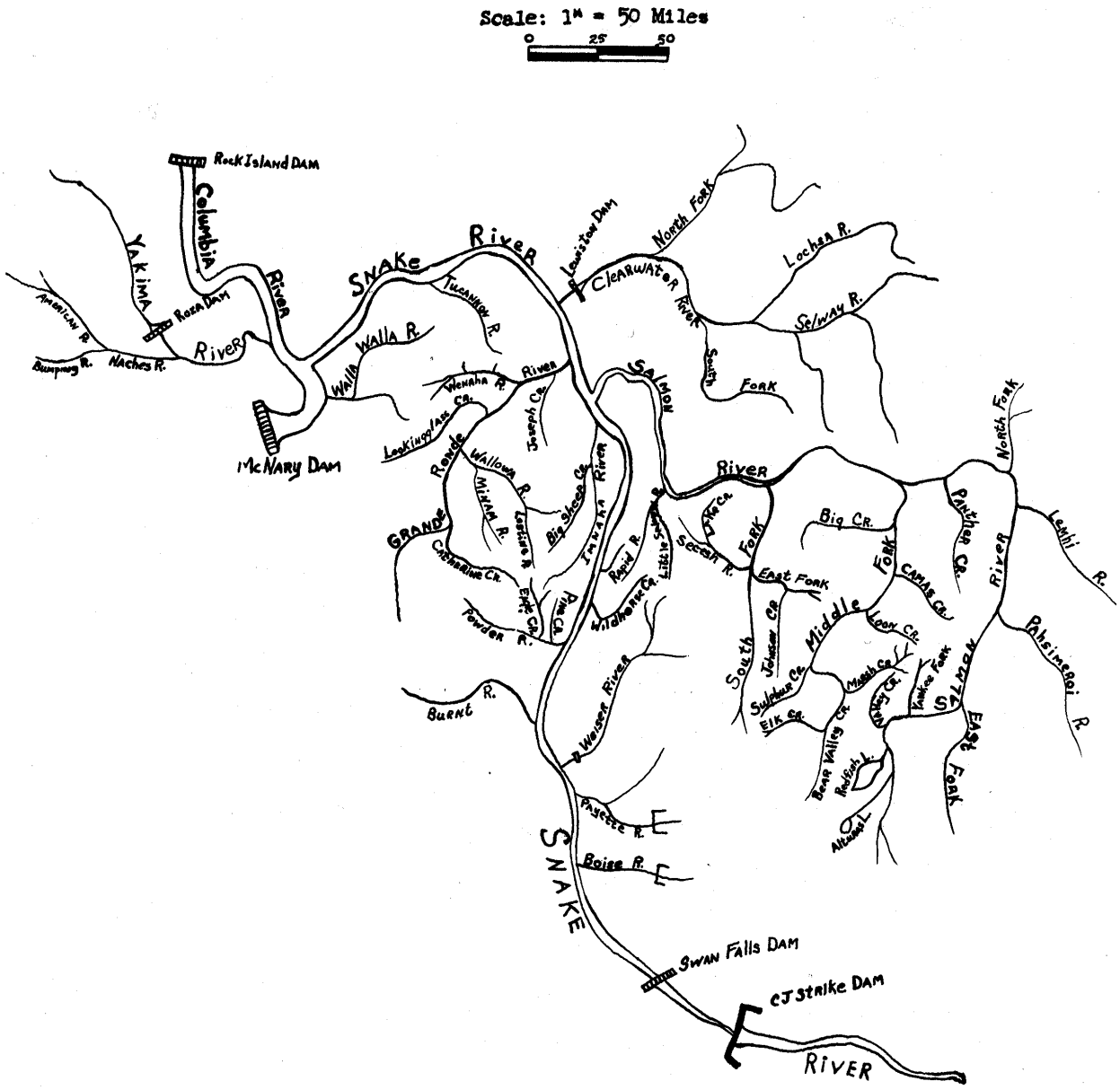
THE SIZE AND TIMING OF RUNS OF ADULT FALL CHINOOK SALMON IN THE COLUMBIA AND SNAKE RIVERS AND THEIR TRIBUTARIES ABOVE THE CONFLUENCE OF THE SNAKE RIVER

1955

Prepared for the U. S. Army, Corps of Engineers
By the Idaho Fish and Game Department

Contract DA 35-026-eng-20608

Figure 1. Map Showing Outline of Study Area



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INTRODUCTION

In agreement with the United States of America, (U. S. Army, Corps of Engineers), under contract DA 35-026-eng-20608, the State of Idaho, through its Fish and Game Department, agreed to conduct field studies to estimate the size and timing of runs of adult, anadromous salmonoid fishes entering the Snake River and the tributaries of the Columbia River above the confluence of the Snake River.

The work contained herein is part of the studies made to estimate the escapement of fall chinook salmon and the timing of the runs into the tributaries of the Snake River and the Columbia River and its tributaries above the confluence of the Snake River (Figure 1) .

METHODS

The methods used to determine fall chinook salmon escapements and timing of the runs are the same as those used in 1954. 1/

Aerial counts of spawning nests from the Columbia River were furnished by the Hanford Atomic Energy Commission and the Washington Department of Fisheries for the Hanford area and the Priest Rapids to Rock Island Dam area of the Columbia River, respectively.

The Idaho Fish and Game Department and the Oregon Fish Commission, cooperating, conducted separate air and ground surveys on the Snake River between Swan Falls Dam and Marsing, Idaho. Idaho personnel did not attempt to make an aerial count of redds but instead took aerial photographs of the spawning areas which were later used to obtain a redd count. The photographer used a K25 camera set at 1/450 second with a lens opening of f.4. The photography was done through a specially prepared aperture in the floor of the plane while flying at speeds of 100 to 125 mph at 4000 to 4500 feet mean sea level. Pictures were taken only in areas where redds could be observed and when more than one photo was necessary to cover an area they were allowed to overlap. Redd counts were taken from black and white, glossy prints which showed the spawning nests as light colored areas with characteristic shapes, Plates 1, 2 and 3.

FINDINGS

Spawning Ground Surveys

No attempt was made to count spawning nest from the ground as previous experience indicated that aerial redd counts were more accurate than ground counts in larger streams.

The ground surveys are summarized in Table 1.

1/ The size and timing of runs of anadromous species of fish in the Columbia and Snake River and their tributaries above the confluence of the Snake River, 1954. Annual Report to the U. S. Army, Corps of Engineers, Idaho Department of Fish and Game, 518 Front Street, Boise, Idaho.

Table 1. Tabulation of Snake River fall chinook spawning ground survey data, 1955
(Swan Falls Dam to Marsing, Idaho)

Stream Area	Date	Dead Fish** M	Dead Fish** F	Dead Fish** Un	Degree Spawned* Spent M	Spent F	Partially M	Partially F	Unspawned M	Unspawned F	Live Fish	Visibility	Weather
Swan Falls Dam downstream to 2 miles below U.P. Railroad bridge	11/8	31	32	5	30	32	1	0	0	0	4	Fair	Clear
From 2 miles below U.P. railroad bridge to ½ mile above Givens Hot Springs	119	54	29	2	53	29	0	0	1	0	4	Fair to Good	Mostly Clear
From point ½ mile above Given's Hot Springs to 2 miles below	11/10	9	3	0	9	3	0	0	0	0	0	Poor	Cloudy-Windy
From point 2 miles below Givens Hot Springs to 4 miles above Marsing	11/11	8	0	1	8	0	0	0	0	0	0	Poor	Cloudy-Windy Sub-zero temperature
From U.P. railroad bridge downstream 2 miles	11/15	3	7	0	3	7	0	0	0	0	0	Poor	Cloudy-Windy Sub-zero temperature
From Swan Falls Dam to ½ mile above U.P.R.R.	11/22**	2	4	4	-	1	1	-	-	-	0	Fair to Poor	Overcast
From ½ mile above U.P. railroad bridge to Given's Hot Springs	11/23**	4	12	-	1	12	1	-	_ -	-_	0	Fair to Poor	Overcast
Totals		111	87	12	104	84	3	0	1	0	8		

* M is male, F is female, and Un for unknown sex. ** Data from Oregon Fish Commission surveys.

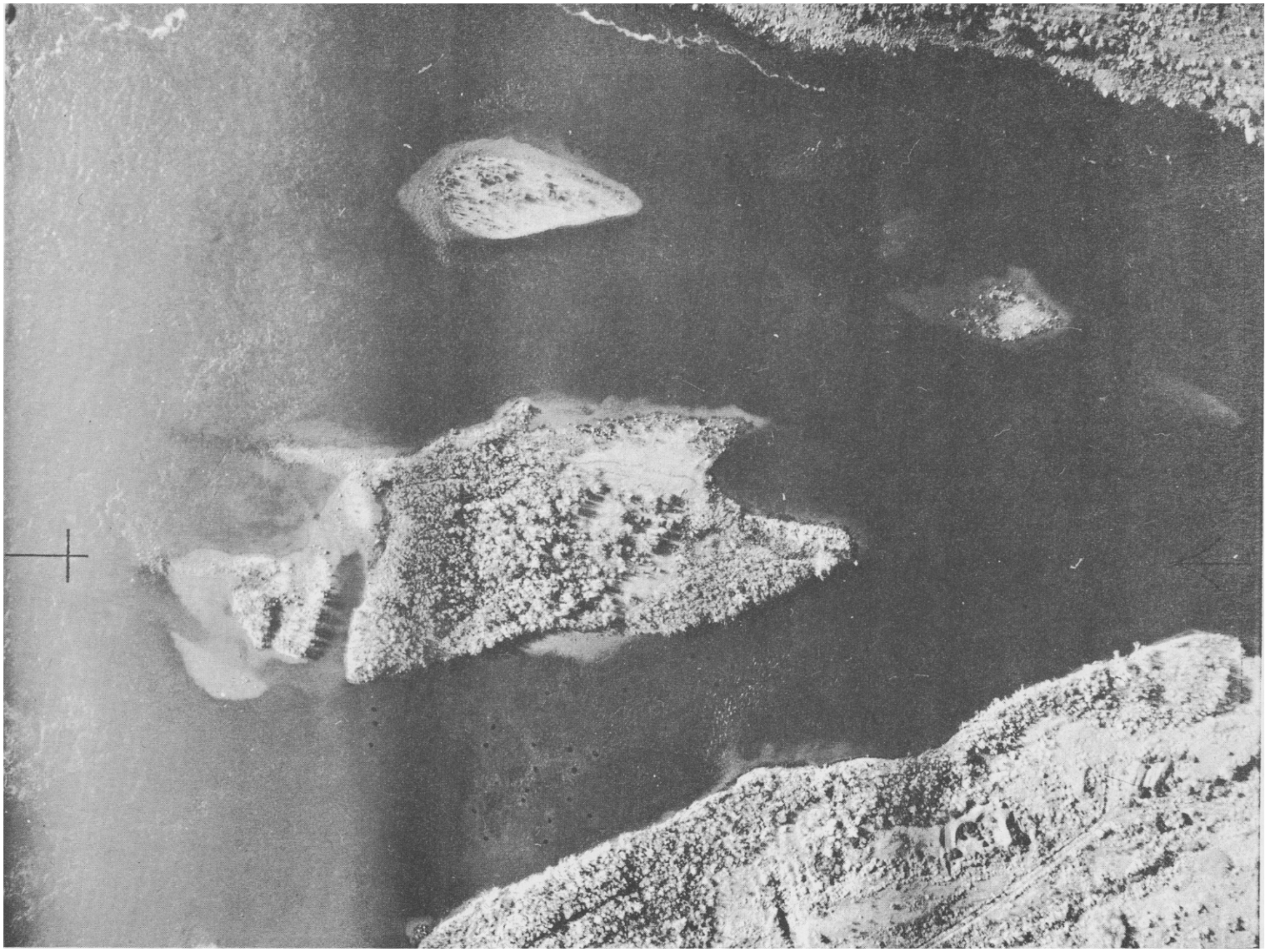


Plate 1. Aerial view of Snake River immediately below Swan Falls Dam showing chinook salmon spawning nests. Each discernible nest is dotted. Arrow points upstream.

Survey of November 8

On November 8, three survey crews consisting of two men each, covered the area from Swan Falls Dam downstream to approximately one and one-half miles below the Union Pacific railroad bridge (See Figure 2). During the surrey 31 dead males, 32 dead females, 5 dead of unidentified sex and 4 live chinooks were observed. Visibility during the day was considered fair to good.

Survey of November 9

The area from about one and one-half miles below the railroad bridge to approximately one-half mile above Given's Hot Springs was surveyed on November 9. Dead chinook observed on the survey included 54 males, 29 females and 2 of unidentified sex. Four live chinook salmon were observed during the day. Visibility was fair to good.

Survey of November 10

The survey was continued from a point approximately one-half mile upstream from Given's Hot Springs to about two miles below the Hot Springs, on November 10. Nine dead male and 3 dead female chinooks were observed during the day. Visibility was poor and inclement weather caused an early termination of the survey.

Survey of November 11

On November 11, the area from two miles below Given's Hot Springs to four miles above Marsing was surveyed. Unfavorable, windy weather prevailed during the day limiting observations to a few feet near the shoreline. Eight dead males and one chinook of unidentified sex was observed.

Survey of November 15

The ground survey was terminated on November 15, one and one-half miles below the Union Pacific railroad bridge. In one and one-half mile section surveyed on this day three dead male and seven dead female chinook salmon were found. Inclement weather in the form of wind and sub-zero temperatures precluded a satisfactory coverage during the survey.

Oregon Fish Commission Survey on November 22 and 23

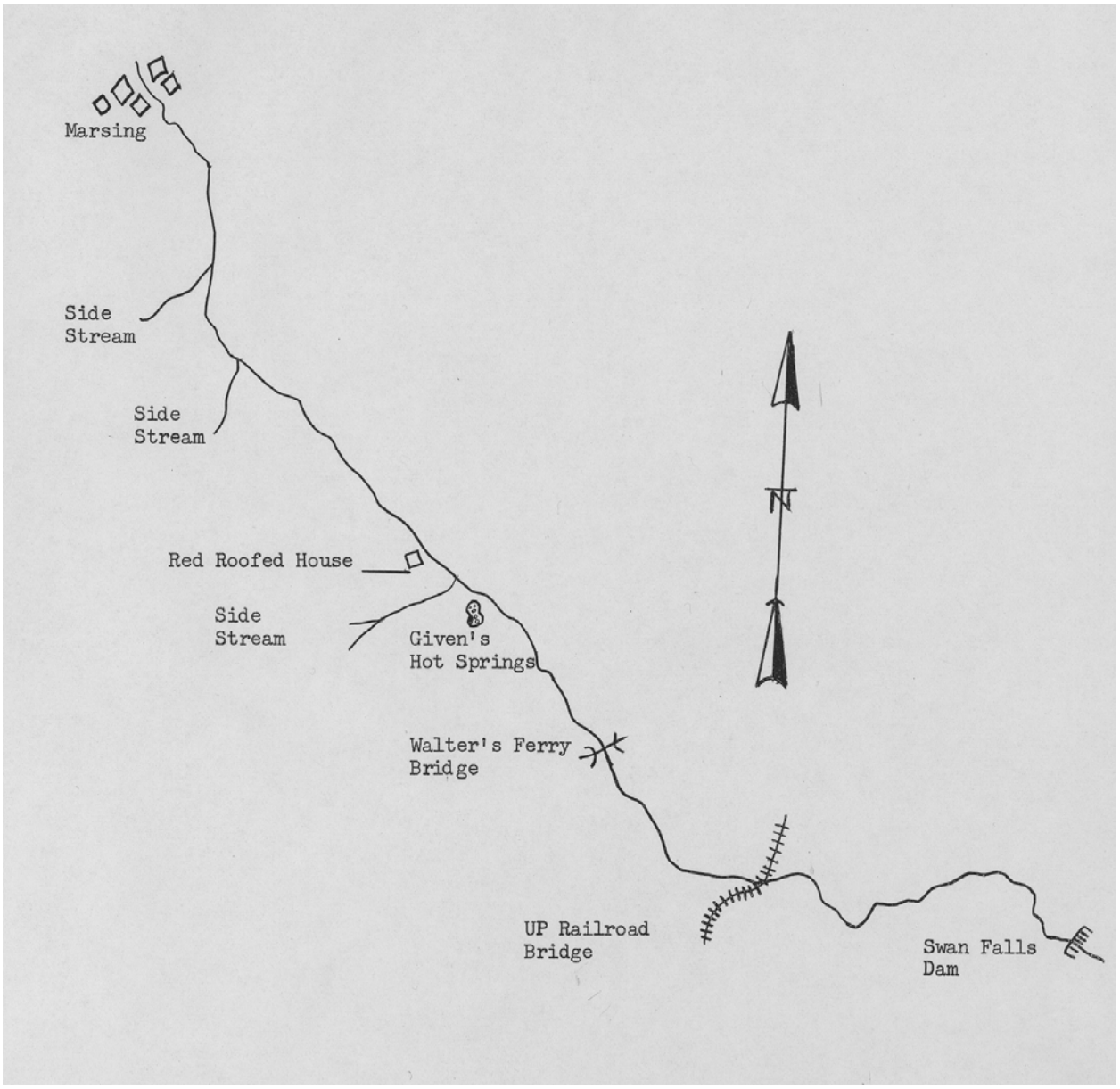
A separate survey of the Swan Falls Dam to Marsing area of the Snake River was conducted by Oregon Fish Commission personnel on November 22 and 23. The primary objectives of the survey were to observe as many dead chinooks as possible and examine them for evidence of marks and tags.

The methods used during the survey were the same as the methods used on Idaho surveys. Data collected during the survey included 6 dead. males, 16 dead female and 4 chinook of unidentified sex. Sixty-one other chinook were observed, 51 previously checked by Idaho and 10 others not determined if checked previously.

Aerial Surveys

Aerial counts of redds were made in the same area covered during the ground surveys on the Snake River.

Figure 2. Outline of Snake River Survey Area (Swan Falls Dam to Marsing). Scale 1/3 inch = 1 mile.



The Oregon Fish Commission made aerial counts on November 22 during which time visibility was considered fair and was limited to a depth of approximately four feet by turbid water. A total of 513 redds was counted.

On December 8, Forrest Hauck made an aerial survey of the spawning areas taking aerial photographs instead of making redd counts. The negatives were later enlarged and a redd count made from the enlargements. The number of redds discernible on the photos totaled 476.

The aerial survey counts made within the Hanford area on the Columbia River were supplied by the Atomic Energy Commission biologist. A total of 64 redds was recorded from Ringold to below Priest Rapids.

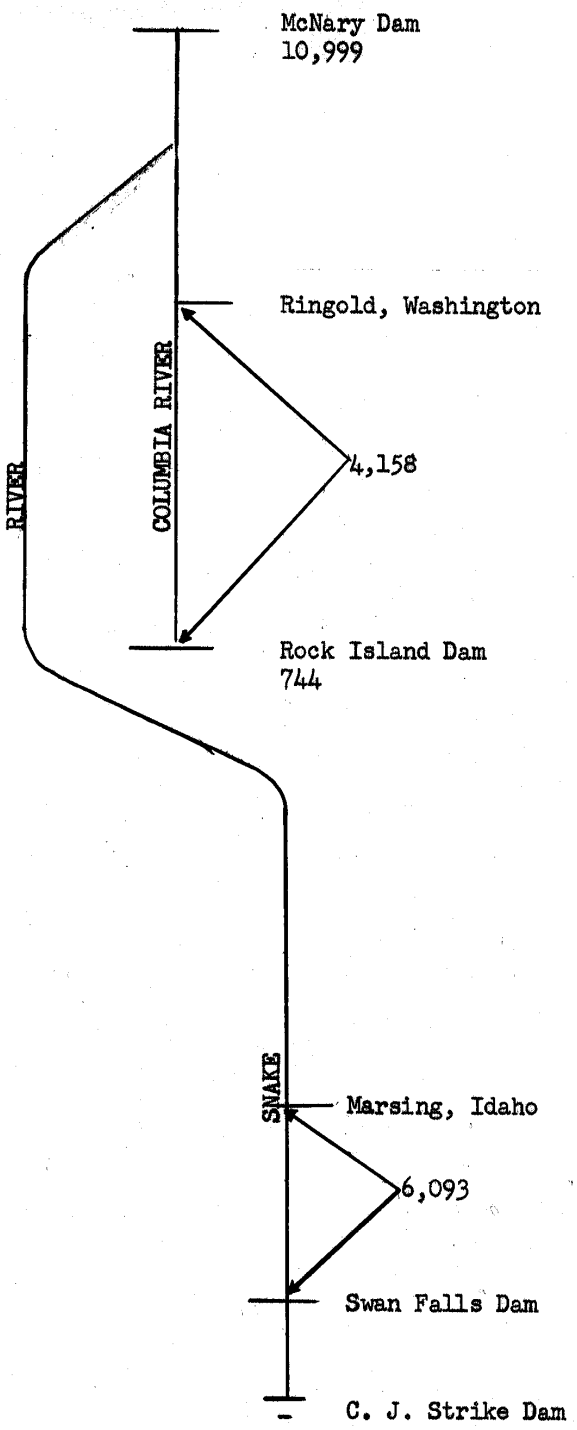
The total of 111 redds between Priest Rapids and Rock Island Dam on the Columbia River was counted by the Washington Department of Fisheries.

Table 2. Minimum Estimates of Fall Chinook Salmon Escapements in the Columbia River Between Rock Island Darn and Ringold and in the Snake River Between Swan Falls Dam and Marsing - 1955.

	1	2	3	4
Stream	Redds Counted	Adjustment Made	Total Redds	Minimum Escapement***
Columbia River	175*	100%	350	795
Snake River	513**	None	513	1,165
Totals	688		863	1,960

* Data from the Washington Department of Fisheries and the Hanford Atomic Energy Commission.
** Data from the Oregon Fish Commission.
*** Using the sex ratio of 1.27 males: 1 female.

Figure 3. A Diagammatic Distribution of the Prorated Escapements of Fall Chinook Above McNary Dam, 1955



ANALYSIS AND DISCUSSION

Population Estimates

The escapements and the prorations are calculated similarly for the Snake and Columbia Rivers and in the same way as in 1954 (Footnote 1/). The data from field and aerial surveys is summarized in Tables 1 through 3 .

A minimum estimated spawning escapement of 795 fall chinook in the Columbia River between Ringold, Washington and Rock Island Dam was calculated by using a sex ratio of 1.27 males to 1 female, assuming the sex ratio of the two races is similar. An adjustment of 100 per cent was made to the aerial redd count to compensate for the physical characteristics of the Columbia River and the difficulty in making counts. The minimum estimated escapement of 1,165 fall chinook for the Snake River between Swan Falls Dam and Marsing, Idaho was similarly calculated by using the sex ratio of 1.27 males to 1 female (Table 2) . No adjustment was made to the Snake River aerial redd count. The count must be considered a minimum figure because high, turbid water conditions made counting difficult. Oregon Fish Commission redd counts from the Snake River were used in making escapement estimates of fall chinook in Swan Falls Dam - Marsing, Idaho area. Aerial photo counts were obtained by Idaho personnel but these were not used for reasons explained later in the text.

The total numbers of fall chinook available to the study area is estimated to be 10,255 determined from breaking the McNary Dam count on August 21 and the Rock Island Dam count on September 1. A total of 10,999 chinook passed McNary Dam after August 20, of which 744 were counted at Rock Island Dam after September 1. By using the spawning ground data a factor of 5.24 was determined by dividing the minimum estimated escapement (1,960) into the available fall chinooks (10,255). The factor of 5.24 is used to calculate the prorated escapement. Thus the estimated escapements of fall chinooks in the Columbia River survey area is increased to 4,158 and in the Snake River survey area to 6,093. The calculations were carried to two places and rounded off to the nearest whole number which leaves 4 fall chinooks not accounted for.

Timing of Runs

The pattern of migration of chinook salmon in relation to time is well established as the runs over dams in the Columbia River indicate. For example, the expression of the chinook salmon runs over Bonneville Dam are closely followed by similar expressions at McNary Dam, indicated by the general peaking of the runs. 2/

1/ A diagrammatic distribution of fall Chinook is shown in Figure 3.
2/ Chinook salmon fish counts at Bonneville and McNary Dams, Annual Report of Passage of Fish over Bonneville and McNary Dams, 1954. Corps of Engineers, U. S. Army, Portland, Oregon and Walla Walla, Washington.

Table 3. Fork Length Frequency Distribution and Sec Ratio of 199 Fall Chinook Salmon From Snake River, 1955*

Length (inches)**	Male	Female	Unidentified
17	1		
18	1		
19	1		
20	3		
21	3		
22	4	1	
23		1	
24	1		
25			
26		1	
27	2	1	
28	6		
29	4	7	
30	8	10	
31	10	9	
32	6	10	
33	2	10	
34	5	4	
35	2	6	1
36	7	13	
37	5	9	
38	11	3	
39	2	1	
40	4		
41	7	1	
42	8		
43	4		
44	2		
45	1		
46			
47			
48			
49			
50	1		
Totals	111	87	1
Sex Ratio	1.27	1	

* Twenty-two lengths are from Oregon Fish Commission surveys.
** All measurements were taken to the nearest ½ inch. The ½ inch measurements are distributed randomly in the above table.

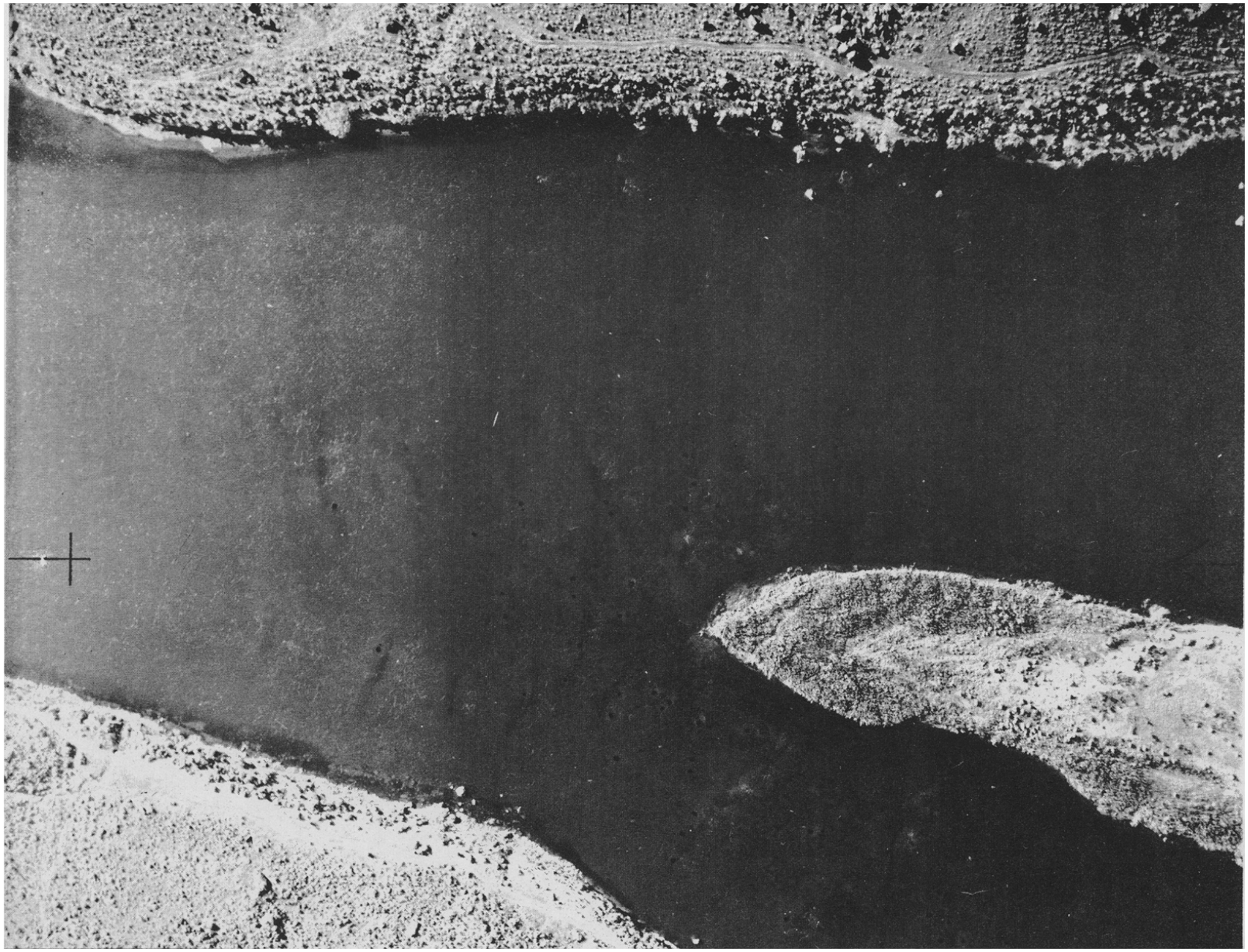


Plate 2. Aerial view of chinook salmon spawning in Snake River just above old railroad bridge.

A similar pattern is exhibited between the peaking of chinook salmon runs at McNary and Rock Island Dams; however, the expression is not quite as definite .

Fall chinook salmon pass McNary Dam from August through November as determined from breaking the McNary Dam count on August 21. They are present in the Columbia River between McNary and Rock Island Dams from August through November, with peak dates in September. The break between spring and fall chinook at Rock Island Dam occurred about September. Data is incomplete for chinook which spawn in the Snake River below Swan Falls Dam. Fall chinook salmon were observed spawning in the Swan Falls Dam -Marsing, Idaho area of the Snake River on October 22 and live chinooks were observed during the spawning ground survey in November.

Aerial Photography

In 1955, aerial photographs were taken of the spawning nests of fall chinook salmon in the Snake River on an experimental basis. The results of the work proved very promising as a means of obtaining a permanent record from which redd counts could be made.

The photographic counts were not used in making estimates of escapements because of the experimental nature of the work; however, the total photo count (476) closely approximates the aerial redd count (513) made by Oregon Fish Commission personnel. The redd count from photographs was considered a minimum figure for the following reasons: Redds in deep water did not show clearly in the enlargements: Possibility of missing spawning areas at the edge of the photographs because of light reflection at angles other than vertical, and the photographer was not sure that film was left in the camera when lower river areas were photographed.

In addition to the aerial photographs taken with the K25 camera described earlier, a Graphic camera was used with a K2 filter on black and white, Super XX film and with a haze filter on Ektachrome film. The aerial camera without filters produced better results than either of the above.

The possibility of using aerial photography in obtaining counts of spawning nests appears very favorable and the actual application in future work should be further examined in 1956.

Length Frequency Distributions and Sex Ratio

The fork length measurements of 199 fall chinook salmon measured on the spawning grounds in the Snake River are shown in Table 3. Sizes ranged from 17 to 50 inches with an average of 33.3 inches for 111 males, 33 inches for 87 females and an average of 33.17 for both males and females. Figure 4 compares the 1954 and 1955 data. There is close similarity.

Figure 4. Fork Length Frequency Distribution of Fall Chinook Salmon From Snake River, 1954 - 1955

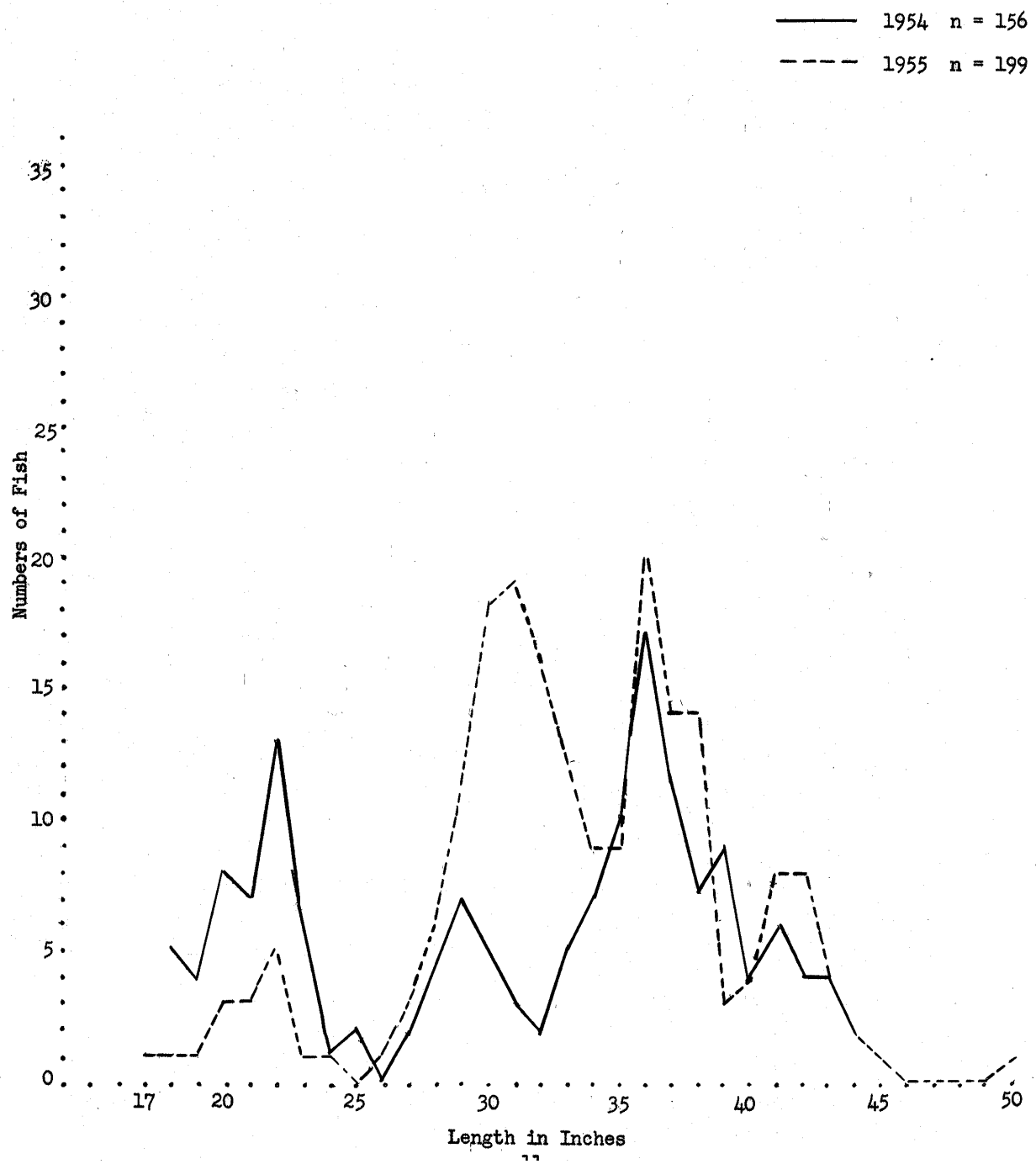


Plate 3. Aerial view of chinook salmon spawning nests in Snake River about one mile below railroad bridge (Murphy).

The sex of fall chinook was determined by examination of the gonads during spawning ground surveys. The sex ratio of the 199 fall chinook examined was found to be 1.27 males to 1 female as compared to 1.6 males to 1 female, in 1954.

Spawning Success

The relative spawning success was determined by examination of the gonads of dead chinook found on the spawning ground. The spawning success as determined during the surveys is used as a relative measure and for this study was designated as: (a) successfully spawned, 75 to 100 per cent; partially spawned, 25 to 75 per cent and unspawned, 0 to 25 per cent spawned. Several sources of error may exist such as differences in sampling techniques and interpertation by different field personnel and the amount of deterioration or desiccation of the gonads at the time of examination.

The relative spawning success in 1955, determined from examining 192 usable carcasses, was excellent, (Table 1). For 108 males, 96 per cent were spent, 2.7 per cent partially spent and 1.3 per cent unspawned. Of the 84 females examined all were found to be spent.

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Submitted April 5, 1956

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SUMMARY

1. Field surveys of fall spawning chinook in the Swan Falls Dam to Marsing, Idaho area of the Snake River were continued in 1955: These included both ground and aerial surveys.

2. A minimum estimated escapement of 795 fall chinook is given for the Columbia River between Ringold, Washington and Rock Island Dam.

3. A minimum estimated escapement of 1,165 fall chinook is given for the Snake River between Swan Falls Dam and Marsing, Idaho.

4. The estimated escapements of fall chinook in the Columbia River area is increased to 4,158 and in the Snake River area to 6,093, by proration of available fish (McNary counts less Rock Island Counts).

5. The break between spring and fall chinook migrations occurred at McNary Dam on August 21 and at Rock Island Dam on September 1.

6. Fall chinook were passing McNary Dam from August through November with peak dates in September, and were present in the Columbia River between McNary and Rock Island Dams these same months. Data for the Snake River is incomplete.

7. Aerial photography of Chinook spawning nests in the Snake River shows good possibility of a reliable method of obtaining permanent records for making redd counts. Of several photographic methods used, the K25 aerial camera, using black and white film and without filters gave the best results.

8. Fork length measurements were taken from 199 fall chinook on the spawning grounds. Sizes ranged from 17 to 50 inches with an average of 33.17 inches for combined sexes.

9. The relative spawning success of the 108 males and 84 females examined was excellent.

RECOMMENDATIONS

1. The experimental photography of spawning nests in the Snake River indicate a promising method of making redd counts. The photography should be continued in 1956, varying techniques in an attempt to increase the accuracy of redd counts. One outstanding advantage of photographs is that they furnish a permanent record.

2. It is recommended that tagging of chinook be done at McNary Dam in August and September to learn more about the habits of the fall spawning chinook, principally about the timing of the runs.

2. It is also recommended that, in the event that tagging is done at McNary Dam, a spawning ground survey be conducted in the Columbia River spawning area and, that tag recoveries be made at Rock Island Dam.

4. It is recommended that an aerial survey be made on the lower Snake River (below Lewiston, Idaho) to determine possible use of this section by fall spawning chinook.